

Programmable Phase Nulling Interferometer for Giant Mirrors, Phase I

Completed Technology Project (2018 - 2019)



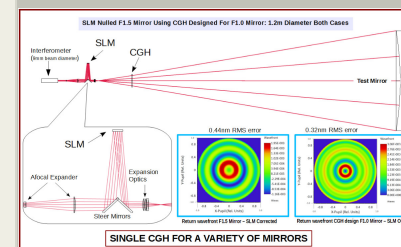
Project Introduction

We propose the development of a programmable phase nulling interferometer that extends the capability of a computer generated hologram (CGH) to null test a range of meter class telescope mirrors, instead of a single one for which it was designed. The active element is a crystal on silicon (LCoS) spatial light modulator (SLM). The SLM corrects for the residual wavefront remaining when a CGH is used to test a mirror for which it was not designed. An aperture F-number trade space exists in which a range of mirrors can be null tested with one CGH. The prototype can be modularly added-on to a railed interferometric test setup with a CGH. In Phase I a system will be constructed with a 512x512 SLM in a brassboard Twyman-Green interferometer to null test a 10 inch F3.5 or F4 parabolic mirror. It will resemble the proposed prototype, but without a CGH, as in this case the SLM alone can null the phase error from the mirror. Tests of null quality and repeatability will be performed and measures to eliminate modulo 2π phase artifacts will be implemented. The Phase 1 brassboard will be controlled with a labVIEW executable and delivered to NASA.

Anticipated Benefits

Optical test metrology for giant telescope mirrors; beam steering for satellite communication links; holographic optical trapping.

Optical test metrology for giant telescope mirrors; optical test metrology for small scale commercial and custom optics; ground and satellite based beam steering; holographic optical trapping in biotechnology; multi-photon microscopy in biotechnology.



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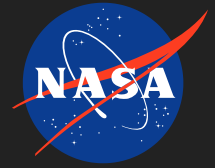
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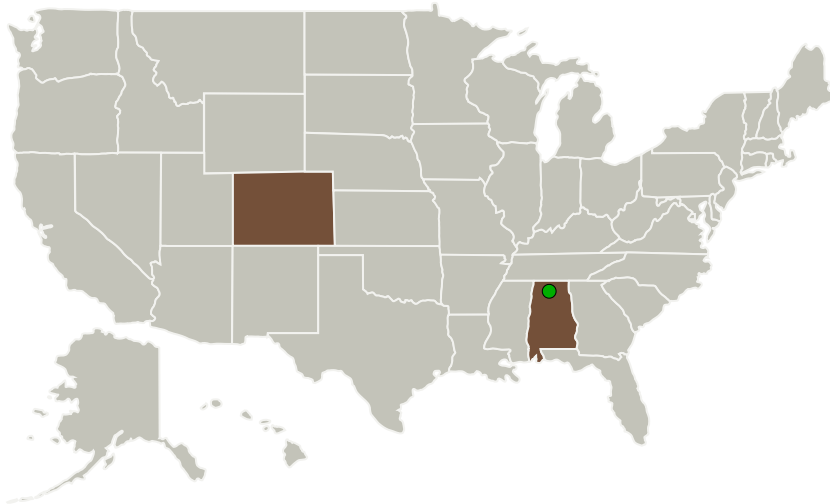
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Boulder Nonlinear Systems, Inc.	Lead Organization	Industry	Lafayette, Colorado
● Marshall Space Flight Center (MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama Colorado

Project Transitions

**July 2018:** Project Start**February 2019:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/137885>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Boulder Nonlinear Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

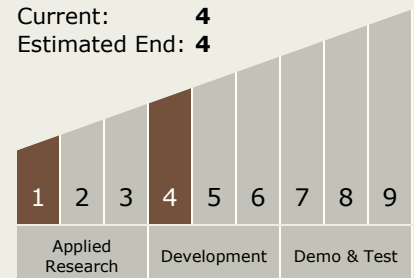
Carlos Torrez

Principal Investigator:

Hugh Masterson

Technology Maturity (TRL)

Start: **1**
 Current: **4**
 Estimated End: **4**

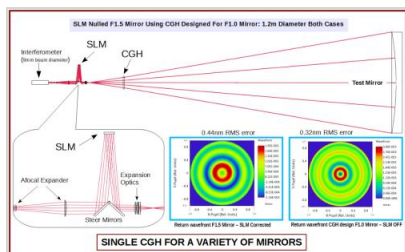


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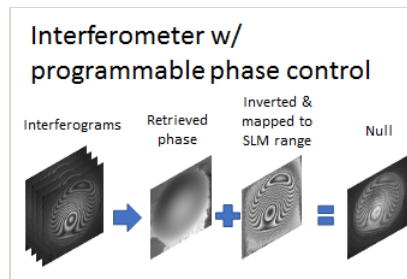
Images



Briefing Chart Image

Programmable Phase Nulling Interferometer for Giant Mirrors, Phase I

(<https://techport.nasa.gov/image/127111>)



Final Summary Chart Image

Programmable Phase Nulling Interferometer for Giant Mirrors, Phase I

(<https://techport.nasa.gov/image/135836>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.3 Optical Components

Target Destinations

Outside the Solar System,
Others Inside the Solar System